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A DESCRIPTION OF THE MALE OF *JORDANOPSYLLA ALLREDI* TRAUB AND TIPTON, 1951, AND CHARACTERIZATION OF THE TRIBES WITHIN ANOMIOPSYLLINAE (SIPHONAPTERA: CTENOPHTHALMIDAE)

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Abstract.—The male of *Jordanopsylla allredi* Traub and Tipton, 1951 is described, observations recorded, and distributional records noted. Tribes of the subfamily Anomiopsyllinae are reviewed and descriptions of each are provided. A key to the tribes is included for the subfamily Anomiopsyllinae.

Key Words: Siphonaptera, Ctenophthalmidae, *Jordanopsylla allredi*

Jordanopsylla allredi Traub and Tipton, 1951 was described from two females from Southwestern Utah. Subsequently, three males and two females were reported by Beck and Allred (1966) from the Nevada Test Site, Nevada, as *J. allredi*. These latter specimens constitute an undescribed species. A third female was reported by Augustson and Durham (1961) from northwestern Arizona (see Distributional Records). Males of *J. allredi* were independently collected in Southwestern Utah by all three authors, but were never described. The purpose of this paper is to review the systematic position of the genus *Jordanopsylla* and other genera within the subfamily Anomiopsyllinae, describe the male of *J. allredi*, record some observations, and document the rare distributional records of *J. allredi*.

Anomiopsyllinae Baker, 1905

A description of Anomiopsyllinae, in which *Jordanopsylla* is placed, can be reviewed in Holland (1985). It is one of nine subfamilies in the family Ctenophthalmidae (Anomiopsyllinae, Ctenophthalminae, Dinopsyllinae, Doratopsyllinae, Listropsyllinae, Liuopsyllinae, Neopsyllinae, Rhadinopsyllinae, and Stenoponiinae). Some confusion exists as to what genera belong in Anomiopsyllinae. Ioff and Argyropulo (1934) erected *Wagnerina* and placed it in the subfamily Ceratophyllinae, but later Ioff and Scalon (1954) treated *Wagnerina* as a distinct subfamily (Wagnerinae) of Ctenophthalmidae. Hopkins and Rothschild (1962) attributed the genus to the tribe Jordanopsyllini, while Yu et al. (1990) included it in Anomiopsyllinae without tribal designation. Comparison of *Wagnerina* (Table 1 of Traub and Tipton 1951) with *Anomiopsyllus, Callistopsyllus, Conorhinopsylla, Jordanopsylla, Megarthroglossus,* and *Stenistomera* indicate it clearly belongs to the Anomiopsyllinae, but warrants assignment to its own tribe, Wagnerinini Ioff and Argyropulo, 1934. Although Ioff and Argyropulo (1934) did not designate, or provide a description of the tribe Wagnerinini, they did erect the genus upon which the tribal name is based. *Jordanopsylla* remains assigned to Jordanopsyllini. *Eopsylla* has traditionally been placed in the Anomiop-

syllini, however, specimens were not available for study and it is not addressed here.

KEY TO THE TRIBES OF ANOMIOPSYLLINAE

1. Pleural arch vestigial, or absent; lateral metanotal area absent; metepimeron fused to metanotum (Nearctic) ..... Anomiopsyllini
– Pleural arch well developed; lateral metanotal area present; metepimeron and metanotum not fused 2
2. Pronotal comb present, plantar bristles displaced onto sole of metatarsus v (eastern Palearctic) ..... Wagnerinini
– Pronotal comb absent, plantar bristles absent on sole of metatarsus v (southern Nearctic) ..... Jordanopsyllini

Anomiopsyllini Baker, 1905

The genera *Anomiopsyllus, Callistopsyllus, Conorhinopsylla, Megarthroglossus,* and *Stenistomera* belong to this tribe.

Number of preantennal rows of bristles 2 or more, apex of maxillary lobe acute, males without occipital groove (except *Megarthroglossus,* slight indication), pronotal comb present (except *Anomiopsyllus*), dorsal margin of mesonotum distinctly longer than metanotum by at least ⅓, lateral metanotal area and pleural arch absent, dorsoanterior margin of metasternum concave, squamulum present (except in males of *Megarthrogloss*sus*), metepimeron fused with metanotum, anteromesal setae of coxae II and III absent on upper fourth, tarsi V with 5 pairs of plantar bristles, first displaced onto plantar surface, abdominal tergites with a single row of setae (except *Conorhinopsylla* which has 2 rows), and 4 or more spinelets on T-I.

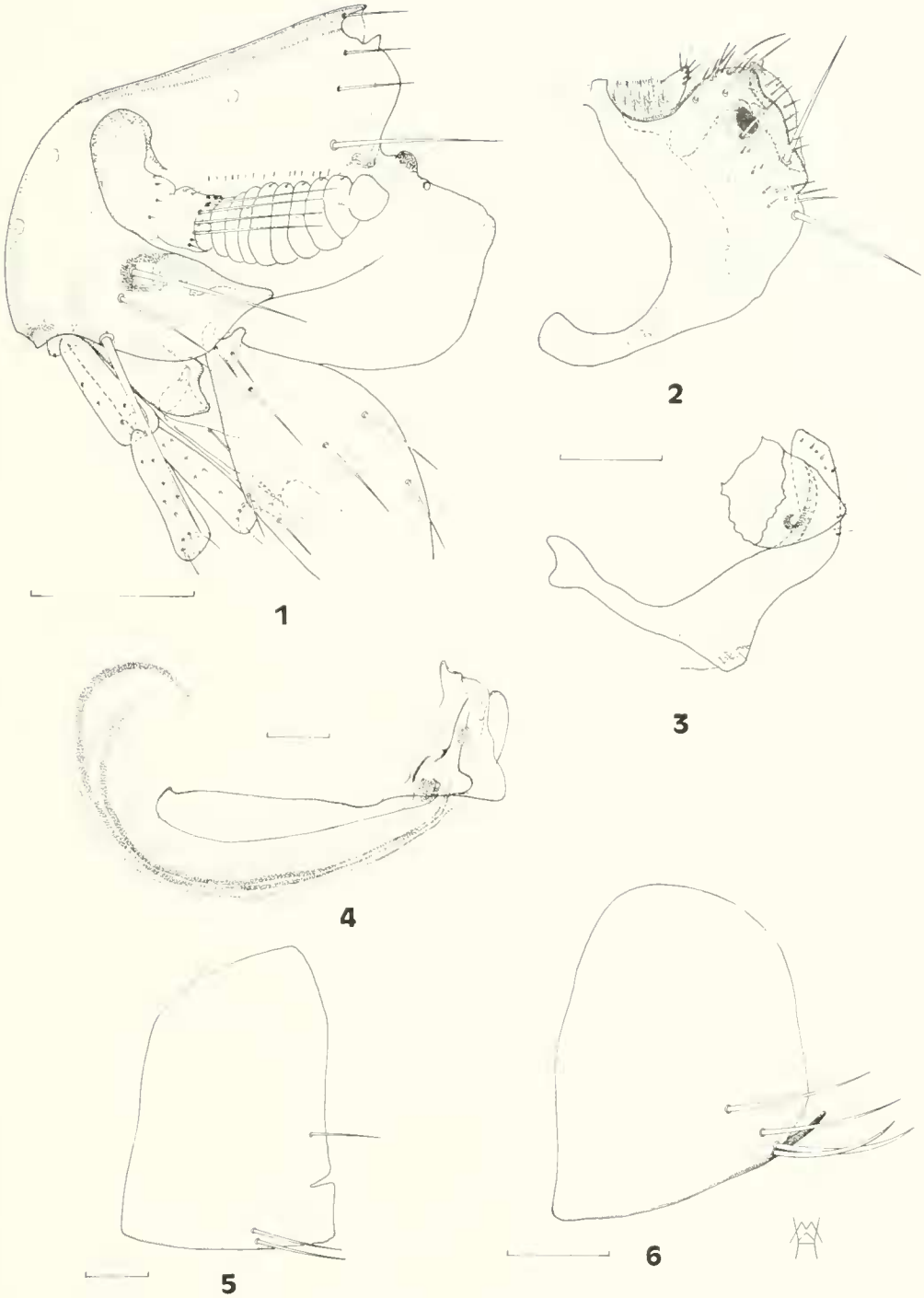
Wagnerinini Ioff and Argyropulo, 1934

Preantennal area with 2 distinct rows of setae, large seta at apex of rounded genal lobe, 3 rows of setae in occipital area (anterior 2 rows reduced to minute setae), disjunct row of thin setae along dorsal margin of antennal fossa apposed to traditional minute spiniform setae, tentorial arch anterior to vestigial eye. Pronotal comb present, dorsal margin of mesonotum longer than metanotum by at least ⅓, well developed lateral metanotal area, dorsal anterior margin of metasternum convex and ventral anterior margin truncate, metepimeron not fused with metanotum. Anteromesal setae of coxae II and III absent on upper fourth, tarsus V of all legs with 5 pairs of plantar bristles, first pair displaced onto plantar surface. All abdominal tergites with 2 rows of setae, marginal spinelets on T-I-III, 1–3 antesensilial bristles in female and T-VII of male with caudally projecting lobes in traditional position of antesensilial bristles, the latter indiscernible or reduced to minute hairs (except *Wagnerina schelkovnikovi* Ioff and Argyropulo, 1934, which is without lobes and possessing a single antesensilial bristle), spiracle on T-VIII remote from sensillium, anal stylet reduced, hardly longer than wide, with single long bristle. Sternites VIII and IX fused and tendon of St-IX lost.

Jordanopsyllini Traub and Tipton, 1951

The erection of Jordanopsyllini (in the absence of males) was based on the presence of a lateral metanotal area, a moderately well developed pleural arch, metepimeron not fused with the metanotum, dorsoanterior margin of metepisternum convex, and absence of squamulum. *Jordanopsylla,* although most closely allied to *Anomiopsyllus* (see Barnes et al. 1977 for a review of the affinities within Anomiopsyllini), does not share the same tribal affinities. The availability of males confirms the tribal characteristics as seen in the female with some clarifications and additions.

Maxillary lobe not reduced (as stated by Traub and Tipton 1951), but well developed and bluntly rounded in both males and females. Distal portion of lobe hyaline and difficult to see (Fig. 1). Maxilla acuminate in all other genera within Anomiopsyllinae. Depth of occipital groove subequal to width of incrassation at oral angle. Dorsal margin of meso- and metanota subequal in length (mesonotum ⅓ or greater than length of metanotum in other genera). Anteromesal setae of coxae II and III extending from base to apex. Tarsal segments V of all legs



Figs. 1–6. *Jordanopsylla allredi*. 1, Head of male. 2, Male clasper. 3, Ninth sternum with fused lateral lobe of aedeagus, male. 4, Aedeagus. 5, Sixth sternum, female holotype. 6, Eighth sternum, male. Scale = 100 μ.

with only lateral plantar bristles, whereas other genera in Anomiopsyllinae have first pair displaced onto plantar surface. Lateral lobe of aedeagus fused to distal portion of St-IX. Tendon of St-IX vestigial.

Jordanopsylla Traub and Tipton, 1951

Generic characters annotated in Traub and Tipton (1951) are expanded with the availability of males. These include the presence of a well developed pleural arch, lateral metanotal area, metepimeron free from fusion to the metanotum, metasternum with a convex anterior margin (all characteristics shared by *Wagnerina*), and absence of genal or pronotal combs (also shared by *Anomiopsyllus*). Characters shared by no other genus in the subfamily include: dorsal margin of mesonotum subequal in length to that of the metanotum and anteromesal setae of coxae II and III from base to apex. Females have a sinus in the caudal margin of the sixth sternum also peculiar to the genus (Fig 5). No males and females examined possess a striarium on the second abdominal sternum, or mesal bristles on the metatibia as was indicated in Traub and Tipton (1951). The second abdominal sternum does possess fine reticulations (not considered striaria) and the metatibia has a lateral row of setae opposed to a mesal row. Additional male characters that typify the genus include a clasper with a very small movable process, an aedeagus with two lateral lobes (distolateral and lateral lobes), and fusion of the apical lobes of St-IX with the lateral lobes of the aedeagus. An additional large lobe occupying a medial position between the lateral lobes might appear as a well developed disto-lateral lobe (typical of many Leptopsyllidae), or as crochet, but the structure is not paired. For lack of better understanding of this prominent structure, it will be hereafter referred to as the end chamber (see under Aedeagus below).

Jordanopsylla allredi Traub and Tipton

Voucher specimens.—♂, ex ♀ *Neotoma lepida* Thomas, Grafton, Washington Co., Utah, 37°10′30″N, 113°05′30″W, M. W. Hastriter, January 13, 1997, deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. 2 ♂, same data, but collected January 11, 1997, deposited in collection of senior author.

Male description.—*Head* (Fig. 1): Frontoclypeal region evenly rounded, incrassation at oral angle. Depth of occipital groove equal to width of incrassation at oral angle. Setae in ocular row 3, ventralmost stoutest and placed at margin of genal area just posterior to origin of maxillary palpus, postoccipital row of 5. Minute punctations throughout head capsule with 3–4 marginal placoids and one in lateral occipital area. Dense line of minute spiniform setae along dorsal margin of antennal fossa. Scape with 3–4 minute setae, 3–4 bristles of pedicel ⅔ length of clavus. Antenna extending onto proepisternum. Well developed arch of tentorium anterior to eye. Eye moderately developed, partially pigmented, and notched ventrally. Genal process subacuminate, maxillary palpus with 4 segments extending to apex of trochanter. Labial palpus with 5 segments, penultimate shortest and apical longest, base of penultimate nearly exceeding trochanter. Laciniae minutely serrate apically, subequal in length to labial palpi. Sclerotized proximal half of maxillary lobe projecting beyond prementum of labial palpus, distal half hyaline, subacuminate, its apex extending to middle of first segment of labial palpus.

Thorax: Indistinguishable from female.

Legs: Lengths of segments comparable to those of female and setation similar. Coxae II and III with slender anteromesal setae extending from base to apex. Segment V of all tarsi with 4 lateral plantar bristles, none displaced onto plantar surfaces.

Unmodified abdominal segments: Tergites I–II each bearing one marginal spinelet per side. Two rows of setae on tergites I–IV. Only one seta in main row extending below spiracles on tergites II–VII. One antesensilial bristle per side. Tergite VIII with one dorsal seta anterior to vermiform spi-

racle, second seta just posterior to spiracle subequal in size to antesensilial bristle. Each side of St-II with one lateral seta, St-III–VII with 2 each and St-VIII with 4. Caudoventral margin of St-VIII with sclerotized extension (Fig. 6).

Modified abdominal segments (Figs. 2–3): Fixed process of clasper with small movable process pivoting at fovea. Length of movable process (3 times its width above fovea) just exceeds dorsocaudal apex of fixed process. Radial lines originating at fovea and at ventral apex of finger. Anterior margin of manubrium forming a smooth semicircle, apically subtruncate. Conical, V-shaped apodeme interconnects left and right claspers. Dorsal body of clasper with 6–7 small marginal setae, 2 larger submarginal setae, 2 large lateral setae near fovea, mesal group of 6–7 minute setae below acetabulum and 3 mesal setae aligned between 2 large acetabular bristles. Movable process with 10–12 minute submarginal setae. Paired St-IX fused at junction of proximal and distal arms, apical lobe enveloped by and fused to lateral lobe of aedeagus, apodemal rod present, although vestigial (Fig. 3). Heel of proximal and distal arms of St-IX with lateral patch of 6–7 minute setae and apical lobe of distal arm bearing 10–12 minute submarginal setae.

Aedeagus (Fig. 4): Aedeagal apodeme broadest medially, tapering to a narrow neck near fulcral lobes. Paired penis rods exceeding aedeagal apodeme, but not coiled. Median dorsal lobe nipple-like, laterally expanded into paired distolateral lobes, lateral lobes, and a single median lobe (end chamber). Apical lobes of distal arm of St-IX envelop end chamber and are enveloped by and fused to lateral lobes. Sclerotized inner tube bears a dorsal tooth basally. Crochets absent.

Size: (Total length mm, mounted specimens) (N = 8) Range = 1.7–2.0, Average = 1.9. Unmounted specimens observed dorsally appear laterally broad with a wide, bluntly rounded head.

Distributional records.—All specimens known to the authors were examined during this study except for the original female paratype (with asterisk). ARIZONA: (1 ♀), Wolf Hole, Mojave Co., ex *Peromyscus eremicus* Baird, 9/4/1959 (sic!), elev. 1070 m [specimen reported by Augustson and Durham (1961) as *J. allredi* were examined and identified as *Thrassis aridis* ssp.]. UTAH: (1 ♀), Grafton (37°10′N, 113°04′W), Washington Co., ex *P. eremicus*, December 17, 1950, elev. 1110 m, A. E. Beck and D. M. Allred - Holotype; (1 ♂), same data but 37°10′30″N, 113°05′30″W January 11, 1997, elev. 1150 m, M. W. Hastriter; (2 ♂), same data but ex *N. lepida*, January 13, 1997; (1 ♂), Snow Canyon (37°10′30″N, 113°38′30″W), Washington Co., ex *Peromyscus maniculatus* (Wagner), December 28, 1963, elev. 940 m, A. D. Stock; (4 ♂), same data but ex *N. lepida monstrabilis*, December 8, 1989, H. J. Egoscue; *(1 ♀), Springdale (37°11′15″N, 113°00′15″W), Washington, Co., ex *P. eremicus*, November 4, 1950, elev. 1190 m, D. E. Beck and D. M. Allred—Paratype; (1 ♂), St. George (City Springs) (37°07′30″N, 113°35′10″W), Washington Co., ex *P. eremicus*, December 29, 1963, elev. 940 m, A. D. Stock.

Discussion

Throughout the limited range of *J. allredi*, collections have been restricted to the winter months (4 November–13 January). This flea has only been collected on six different occasions within a narrow range of elevations (940–1140 m). The senior author collected it within one half mile of the type locality on a south facing slope characterized by slides and outcrops of basalt boulders. Vegetation included Snake Weed [*Gutierrezia microcephala* (de Candolle)], Brigham Tea (*Ephedra viridis* Coville), Rubber Rabbit Brush [*Chrysothamnus nauseosus* (Pallas)], Pale Cholla (*Opuntia echinocarpa* Engelmann and Bigelow), Common Prickly Pear (*Opuntia erinacea* Engelmann), and Cheatgrass (*Bromus tectorum* Linnaeus). This habitat primarily

supports *Peromyscus eremicus, P. crinitis* (Merriam), and *Neotoma lepida*. It is noteworthy that *Jordanopsylla* has never been collected from *P. crinitis*, although the latter is commonly collected in the same habitat.

The terminal segments (clasper, St-IX, and aedeagus) of one of the males collected in January 1997 were dissected to gain a better understanding of this unusual genus. The aedeagus is not normally fused to the St-IX, but relatively free and easy to separate during dissections. The St-IX and aedeagus were clearly fused and could be separated only by tearing the extended lateral lobe from the aedeagus (Fig. 2). This fusion precludes independent movement of the St-IX and aedeagus relative to one another. This fusion also appears in an undescribed species from Nevada. It is therefore included as a character distinct to this genus not found in other Anomiopsyllinae. Although fine reticulations can be seen on the basal sternite of the holotype of *J. allredi*, a striarium is not discernible. A distinct sinus in the caudal margin of St-VI of the holotype female was not noted in the original description by Traub and Tipton (1951). This sinus is also present in the undescribed species of *Jordanopsylla* from Nevada.

Jordanopsylla is a characteristic nest flea, e.g., reduced eyes, absence of combs and reduced setation, appears to be a poor jumper (although the pleural arch is well developed), a rather slow crawler, and extremely reluctant to surface in the fur when disturbed, or exposed to a stream of compressed CO2 (observations of senior author). Only one of the three specimens was collected on initial examination of two hosts. The other two were retrieved 24 hours after the host was dead and even then were reluctant to leave the host pelage. These tenacious habits may account for infrequent collections of the species. Similar behavior was noted in *Stenistomera alpina* (Baker 1895) and *Anomiopsyllus amphibolus* Wagner, 1936 (the latter considered a nest flea) during the same expedition and may be a feature of true nest fleas, thus enhancing their survival.

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